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## LIST OF SYMBOLS AND ABBREVIATIONS

IWW	-	Industrial wastewater
SSFE	-	Scrapped surface heat exchangers
FC	-	FC
PFC	-	Progressive Freeze Concentration
DOE	-	Design of experiment
CCD	-	Central composite design
RSM	-	Response surface methodology
CC	-	Coil Crystalliser
COD	-	Chemical oxygen demand
RI	-	Refractive index
DSC	-	Differential scanning calorimetric
IP	-	Ice purity
RO	-	Reverse osmosis
K	-	Effective Partition constant
FL	-	Flowrate
CT	-	Circulation time
ISC	-	Initial solution concentration
CTemp	-	Coolant temperature
$\Delta V$	-	Volume reduction
$U_o$	-	Overall heat transfer coefficient
$C_L$	-	Concentration of liquid phase
VOC	-	Volatile organic compounds
FBHE	-	Fluidized bed heat exchanger
TSS	-	Total suspended solids
UV	-	Ultra violet

BOD	-	Biochemical oxygen demand
BTEX	-	Benzene, toluene, ethylbenzene and xylene
TCE	-	Trichloroethylene
PCE	-	Perchloroethylene
$\mu$	-	Chemical potential
$\mu_1$	-	Chemical potential of the liquid
$\mu_s$	-	Chemical potential of the solid
T	-	Temperature
$C_s$	-	Concentration of ice/solid phase
$C_L$	-	Concentration of liquid phase
$V_L$	-	Volume of liquid phase
$V_o$	-	Initial volume of glucose concentration
$C_o$	-	Initial solution concentration
$\bar{v}_{ice}$	-	Average ice growth
$m^2$	-	Meter squared
kg	-	Kilogram
$\rho_{ice}$	-	Mass of melted ice
$\tau$	-	Length of time taken for ice growth
A	-	Area covered by ice on the plate surface
$\omega_{s,\infty}$	-	Mass fraction of the solute
w/w	-	Weight/weight
$\mu m s^{-1}$	-	Micrometer per second
$u_{s,\infty}$	-	Velocity of ice front
ppm	-	Part per million
F	-	Feed flow
$C_p$	-	Specific heat of the feed
$d\theta$	-	Differential increase in time
$dW$	-	Amount of ice crystallized
$\Delta H$	-	Heat of fusion of water
U	-	Overall heat transfer coefficient
$A_m$	-	Mean area for heat transfer
$\Delta T_{log}$	-	Mean logarithmic temperature difference between feed and refrigerant

$h_{amb}$	-	Ambient difference between the outside surface of the freezer and the environment
$\Delta T_{amb}$	-	Temperature difference between the outside surface of the freezer and the environment
$R_F$	-	Freezing ratio
$V_S$	-	Volume of the solid produced
$V_i$	-	Initial solution volume
ID	-	Immersion distance
IR	-	Immersion rate
t	-	Time of process
Bx	-	Brix
$Re$	-	Reynolds number
$D_e$	-	Representative diameter
$u$	-	Average flowrate
$u_o$	-	Fluid viscosity
$De$	-	Diameter
$S$	-	Cross sectional area of the flow
$l_p$	-	Wetted perimeter
ANOVA	-	Analysis of variance
$K_2Cr_2O_7$	-	Potassium dichromate
$Y$	-	Predicted response value
$B$	-	Regression coefficient
$X$	-	Experimental factor influencing the process
$\alpha$	-	Extreme values
R	-	Total thermal resistance from inside to outside flow °C/W
$h_i, h_o$	-	heat transfer coefficient for inside and outside flow, respectively W/(m <sup>2</sup> .°C)
k	-	Thermal conductivity of tube material W/(m.°C)
x	-	Thickness of medium wall
$K_{exp}$	-	K experimental
$K_p$	-	Model predicted K
$\Delta V_{exp}$	-	Experimental value for $\Delta V$
$R^2$	-	R-squared
$T_{wi}$	-	Temperature of the wall at the inlet

$T_{si}$	-	Temperature of the solution at the inlet
$T_{wm}$	-	Temperature of the wall at the middle point
$T_{sm}$	-	Temperature of the solution at the middle point
$T_{cm}$	-	Temperature of the coolant at the middle point
$T_{wo}$	-	Temperature of the wall at the outlet
$T_{so}$	-	Temperature of the solution at the outlet
$T_{co}$	-	Temperature of the coolant at the outlet
$A_o$	-	Outside surface area
$A_i$	-	Inside surface areas of tube
$h_g$	-	Heat transfer coefficient for glucose solution
$h_o$	-	Heat transfer coefficients for ethylene glycol (50%)
$k_i$	-	Thermal conductivity of ice
$x$	-	Thickness of ice layer
$A_m$	-	Logarithmic mean area
$R$	-	Radius of copper tube for the CC
$T_b$	-	Bulk solution temperature
$\Delta T_b$	-	Bulk solution temperature difference, °C
$T_c$	-	Bulk coolant temperature
$L$	-	Total length of the CC
$dw/dt$	-	Mass of ice formed in time $t$
$\Delta H$	-	Heat of fusion of water
FPD	-	Freezing point depression

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